

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

Level: B. Sc.

Year : III

Exam Roll No. :

Time: 30 mins.

Course : MATH 301

Semester : I

F. M. : 20

Registration No.:

Date : 07 07 2017

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blanks by the most appropriate word(s), figure(s) or symbol(s).

1. The inverse of the statement "If ABC is a right angled triangle, then $AB^2 + BC^2 = AC^2$ " is _____
2. Write the meaning of $(p \vee q) \Leftrightarrow r$, if p : Today is Tuesday, q : It is raining, r : It is cold. _____
3. Let m and n two positive integers such that $m = \prod_{i=1}^k p_i^{a_i}$ and $n = \prod_{i=1}^k p_i^{b_i}$, where p_i 's are primes and a_i 's and b_i 's are positive integers, then $\prod_{i=1}^k p_i^{\min(a_i, b_i)}$ represents _____
4. $[4](\text{mod } 5) + [3](\text{mod } 5) =$ _____
5. Let $A_n = \{i \in \mathbb{Z} : n \mid i\}$, $n \in \mathbb{N}$, then $A_3 \cap A_7 =$ _____
6. Let A be a fuzzy set with membership function $\mu_A(x)$, then membership function of the complement of A is given by _____
7. A relation R on a set A is called partially ordering if it is reflexive, transitive and _____
8. In a poset an element is called its _____ if every element in the poset succeeds it.
9. Let $A = (\{1, 2, 3, \dots, 10\}, /)$ be a poset then in subset $\{1, 2, 3\}$, the least upper bound is _____
10. A graph is said to be _____ graph if it is possible to travel from any vertex to all other remaining vertices along a sequence of adjacent edges of the graph.

SECTION "B"
[10Q. × 1 = 10 Marks]

Fill in the blank space by choosing the most appropriate answers from the given choices.

11. $\sim(p \vee q) \equiv$ _____
 (i) $(p \neq q)$ (ii) $\sim p \wedge \sim q$ (iii) $p \vee \sim q$ (iv) $\sim p \wedge q$
12. Let " $k(x)$: x is a student" and " $l(x)$: x is clever." then the statement that "some students are clever" is denoted by _____
 (i) $\exists x (k(x) \wedge l(x))$ (ii) $\forall x (k(x) \wedge l(x))$
 (iii) $\forall x (k(x) \Rightarrow l(x))$ (iv) $\exists x (k(x) \vee l(x))$.

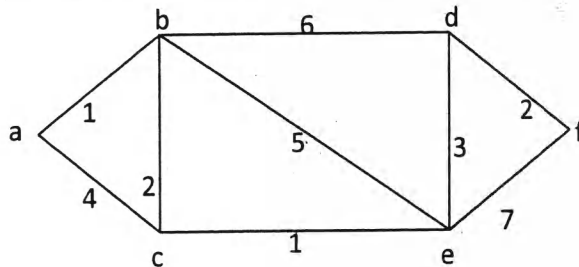
13. Let a and b two positive integers, then $\gcd(a, b) \times \text{lcm}(a, b) =$ _____
 (i) a (ii) b (iii) $a \times b$ (iv) 1
14. Let A_1, A_2, \dots, A_n be subsets of a set A , with (i) $A_1 \cup A_2 \cup \dots \cup A_n = A$ and (ii) $A_i \cap A_j = \emptyset$, for $i \neq j$, then A_1, A_2, \dots, A_n are called _____ of A .
 (i) union (ii) intersection (iii) partition (iv) difference
15. If $A = \{1, 2, 3, 4, 5\}$ and $B = \{4, 5, 6, 7\}$ then $(A \Delta B) \Delta B =$ _____
 (i) $\{1, 2, 3, 4\}$ (ii) $\{3, 4, 5\}$ (iii) $\{6, 7\}$ (iv) $\{1, 2, 3, 4, 5\}$
16. Let $P = \{(1, 2), (2, 4), (3, 3)\}$ and $Q = \{(1, 3), (2, 4), (4, 2)\}$ then $\text{dom}(P \cup Q) =$ _____
 (i) $\{1, 2, 3\}$ (ii) $\{1, 2\}$ (iii) $\{2, 3, 4\}$ (iv) $\{1, 2, 3, 4\}$
17. Which of the following relations represents a poset ? _____
 (i) $R = \{(a, b) \in Z \times Z : |a - b| \leq 1\}$ (ii) $R = \{(a, b) \in Z \times Z : |a| \leq |b|\}$
 (iii) $R = \{(a, b) \in Z \times Z : a | b\}$ (iv) $R = \{(a, b) \in Z \times Z : a - b \leq 0\}$
18. In a graph, the special type of walk in which all vertices and edges are distinct is called _____
 (i) path (ii) circuit (iii) trail (iv) cycle
19. A geometric representation of graph redrawn in such way that no two of its edges intersect except only at the common vertex is called _____
 (i) subgraph (ii) regular graph (iii) planar graph (iv) isomorphic graph
20. A tree with n vertices has _____ edges.
 (i) n (ii) $n - 1$ (iii) $n + 1$ (iv) $n - 2$

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SECTION "C"

[3 Q. × 7 = 21 marks]

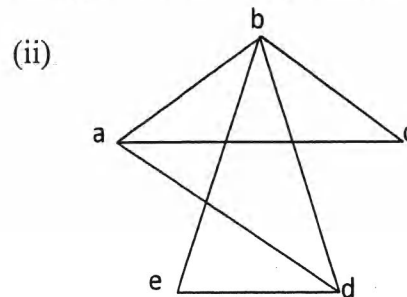
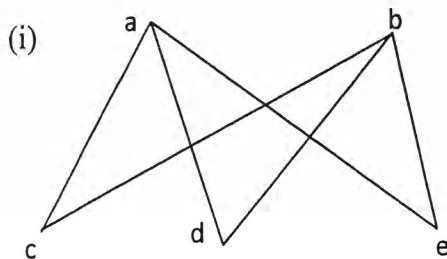
1. If $\gcd(a, b) = 1$, then prove that $\gcd(2a + b, a + 2b) = 1$ or 2 or 3. Solve linear congruence $8x \equiv 2 \pmod{9}$ [4+3]
2. (a) If R and S are two transitive relations defined on set A, then prove that $(R \cap S)$ is transitive. [3]
(b) Define composition of two functions $f: A \rightarrow B$ and $g: B \rightarrow C$. If the function $f: R \rightarrow R$ be defined by $f(x) = x^2 + 1$, then find $f^{-1}(-8)$ and $f^{-1}(17)$. [4]
3. How are graphs represented by (i) adjacency matrix and (ii) incidence matrix? Use Dijkstra's algorithm to determine the shortest path in following weighted graph: [2+5]



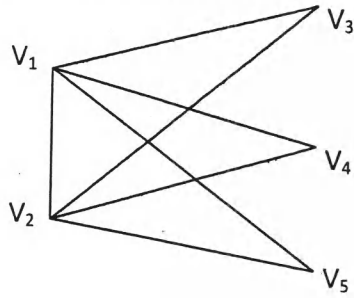
SECTION "D"

[6 Q. × 4 = 24 marks]

4. (a) Construct truth table of statement $(\sim q \Rightarrow \sim p) \Rightarrow (p \Rightarrow q)$.
(b) Prove using 'Logics of Proof' that "If $(p \wedge q) \vee (r \Rightarrow s)$, $t \Rightarrow r$, $\sim (p \wedge q)$, then $t \Rightarrow s$ is valid.
5. Let A and B be two fuzzy sets defined as $A = \{(4, 0.1), (6, 0.5), (8, 0.6), (10, 0.7)\}$ and $B = \{(4, 0.2), (6, 1), (8, 0.4), (10, 0.5)\}$, find $A \cup B$ and $A \cap B$.
6. Use Warshall's algorithm to find transitive closure of the relation $\{(1, 2), (2, 1), (2, 3), (3, 4), (4, 1)\}$ on $\{1, 2, 3, 4\}$.
7. Draw the Hasse diagram represented by the poset $(P(a, b, c), \subseteq)$
8. Show that following graphs are planar by redrawing them so no edges cross-



9. What type of graph is called Eulerian graph? What condition on degree of vertices is satisfied by Eulerian graph? Hence identify whether following graph is Eulerian-



SECTION "E"
[5 Q. × 2 = 10 marks]

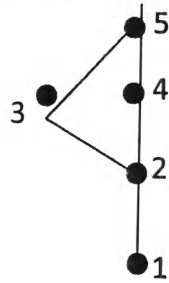
10. Show constructing truth table that the statement $p \Rightarrow (p \vee q)$ is a tautology.
11. Establish using the principle of mathematical induction that
 $2 + 4 + 6 + \dots + 2n = n(n + 1)$

12. Consider a relation R on set $\{1, 2, 3\}$ given by Boolean matrix

$$M_R = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

find the matrix M_R^2 and determine whether R is transitive.

13. Determine the relation represented by following Hasse diagram-



14. Evaluate the prefix expression : $+ - ^ 3 2 ^ 2 3 / 8 - 4 2$